

As it happens, this star is favourably situated for observation when the *Mars* stars are in the zenith, and when they, for "break-neck" reasons, are almost unobservable. I have therefore measured the distance and position-angle of  $\epsilon$  *Indi* relative to five neighbouring surrounding stars, and hope this may serve as the foundation at some future day of a determination of its parallax and proper motion. The distance of *Saturn* from *Mars* was measured on five days, symmetrically disposed with respect to the remarkable conjunction of November 3. The result may afford some interesting data as to the accuracy attainable by means of the heliometer in such measures, and give a determination of the relative positions of these planets which may be of value for future reference.

The proposed observations of *Melpomene* should begin on the 12th inst. (to-morrow), and I trust the weather will suddenly become more favourable.

*Mars Bay, Ascension Island,*  
November 11, 1877.

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*Remarks accompanying Drawing of Mars.* By Geo. D. Hirst, Esq.

As *Mars* during this opposition is not so favourably placed for observation in your latitude as he is here, I venture to forward the enclosed sketch in the hope that it may prove of interest. The drawing has been carefully executed from a fine  $10\frac{1}{4}$  in. reflector, and represents very nearly the appearance of the planet at the present time.

Until lately the markings on *Mars* have been very indistinct, or almost invisible. Even on nights of the finest definition they have been too faint to attempt any effort at delineation, but within the last few days whatever it is that has interfered with our view, either in our own atmosphere or that of the planet, has removed, and the features I have endeavoured to depict are very distinct.

379 *George Street, Sydney, N. S. Wales,*  
August 24, 1877.

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*The Physical Condition of Mars.* By John Brett, Esq.

The following remarks are founded on a series of telescopic observations of the planet from August 2 to October 8, 1877, made with a 9-inch (With-Browning) reflector at the southern extremity of England near the Lizard signal station. The conditions were favourable, and no good opportunities of observation

were neglected; but the results I have to lay before the Society are in one sense extremely unsatisfactory, inasmuch as their tendency is to disturb, if not overthrow, conclusions which have hitherto met with general acceptance. The instrument employed, although of very moderate aperture, is good, and in vindication of its quality it will be sufficient to record that I have had a satisfactory view of the outer satellite of *Mars* with it (on the 15th of September) and, at an earlier date, of the satellite of *Neptune*.

As regards the disk of the planet *Mars*, I must call it emphatically a bad telescopic object, for, under the same conditions of altitude and steadiness, its image will not bear comparison for a moment with *Jupiter* in respect either of quantity or beauty of delicate detail; whilst *Saturn*, as compared with it, is immeasurably superior.

All the modern drawings of *Mars* exhibit well-defined half-tints pervading the so-called seas. I cannot give any account of any of these half-tints. There are certain parts of the dark spaces considerably darker than others, notably so the principal round spot in the equatorial region, and the conspicuous peak next preceding it. But the fact of these markings passing nearly over the centre of the disk, where of course they are seen through a less depth of atmosphere, is sufficient to account for their superior intensity, for the round spot at its first appearance, some two or three seconds within the limb, is not above the average darkness of the markings.

This circumstance alone I consider sufficient to establish the fact that the planet's atmosphere possesses such a degree of opacity as to prevent the telescope doing itself justice on the details, and the total disappearance of these details two or three seconds within the limb of course removes all doubt about their being below the surface. The opacity of the atmosphere is further and most conclusively shown, as I think, by the great brightness of the disk at the limb. The contrast with *Jupiter* in this respect is most interesting.

It is not known that *Jupiter* has any solid nucleus, nor any atmosphere, strictly so called. We only know that he is semi-transparent and limpid to an enormous depth; and his brightness fades away sensibly towards the limb. *Mars*, on the contrary, is believed to be a solid body (his general topography being permanent), with a true atmosphere, and his brightness conspicuously increases towards the limb. The theory that the redness of the so-called land was owing to absorption in the planet's atmosphere is obviously untenable, for the limb, where the atmosphere alone is visible, is nearly white, whilst the central part of the disk is of a glowing red, very like any ordinary solid body heated to a dull red heat. That it is really red hot would of course be inconsistent with the received theory of the snows and seas, but there is reason to believe both these must be given up.

There is one salient fact about *Mars* which I fear cannot be

F 2

gainsaid, and if that is so, the hypothesis that his surface is habitable must be abandoned. There are no clouds.\*

The past autumn has been singularly favourable for observation; I remember none equal to it.

Between the 2nd of August and the 8th of October there has been good definition on eighteen nights. There have been many more observing nights, but I have only counted those when it was worth while to draw. On no one occasion during this series of fine nights has there been a moment's doubt about the identification of the well-known features of the so-called seas. No one of them has been masked or disfigured beyond recognition. Now, supposing there to be land and sea, the evaporation and consequent cooling should be unequal in different regions, and currents must be generated, and therefore clouds wafted hither and thither; and the seas would thereby be sometimes hidden.

Terrestrial clouds are as opaque as anything in nature. The locality of the midday Sun cannot even be suspected when masked by an ordinary cloud, much less could the difference between land and sea be perceived.

That a whole hemisphere should be entirely exempt from clouds for more than two months continuously is, I submit, fatal to the seas.

No man will say that the atmosphere may not be dense enough to sustain clouds, for its density is obvious to the eye; besides, the so-called snows have to be accounted for. Between vapour and snow, the intermediate condition of cloud, or chilled vapour, is inevitable.

If any man says the body of *Mars* is so hot that the vapour will not condense in clouds, I have no objection to offer; but boiling seas are hardly satisfactory.

The white polar patch has always been regarded as snow; but there are one or two things to be said which are unfavourable to this hypothesis, besides the want of clouds to deposit it. In the first place the south polar patch now in view is surrounded with a dark stain, and this darkness is on one side continuous with the so-called sea, and of equal darkness with it. There is no break nor barrier in the straits which join the polar dark patch to the equatorial dark patch. Therefore, if there be snow, it is lying on the sea, or on a polar island.

Beer and Mädler are said to have thought there was a marsh at the borders of the melting snow to account for this dark belt, but most of us would be unable to distinguish a marsh from a meadow when about a mile off. But the worst thing I have to say against the snow is that it lies far above the level of the solid body of the planet. Everybody knows that it appears to project beyond the limb in profile, but the irradiation of its greater brightness has been supposed to explain that away.

The *dark* details of the solid surface disappear long before

\* A hypothetical exception is mentioned later.

they reach the limb, but the *white* detail sticks out beyond it; so that irradiation has a good deal to answer for.

Now I assert that the white patch is not continuous with the surface of the solid, but stands above it; and the evidence I adduce that such is the case consists simply in the shadow of the white patch, which could recently be seen to the eastward after the planet had passed its opposition. My first memorandum of this appearance is dated September 28 at 9<sup>h</sup>, definition being on that occasion the very finest I have had this autumn.\*

The first occasion on which the gibbosity of the disk was noticed was the 5th of October. It was then conspicuous.

The only hypothesis I offer respecting the white polar patch is that it consists of cloud: the neighbourhood of the pole being supposed to be the only region cool enough to condense the vapour.

There is no doubt that cloud would be bright enough, compact enough, and definite enough to supply all the observed peculiarities.

The Earth can show nothing whiter or more sharply defined than its cumulous clouds; and in *Mars*, if the temperature is so great as to dissipate them everywhere else, it is presumable that they would, even at the pole, form themselves only at the outer regions of the atmosphere.

This hypothesis accounts both for the apparent projection and the visible shadow.

The sum of my autumn's work upon *Mars*, therefore, is not only disappointing but grievous. The snows I am sure must be given up, and I sadly fear the seas must go too; and the one little companion globe in the whole solar system on which we could depend has its character taken away.

P.S. Since the 9th of October a patch of light has been noticed to the N.W. of the polar patch, of a diffused character, probably caused by specular reflexion from the outer surface of the envelope, since it is believed not to be affected by the rotation. This requires further observation.

November 9, 1877.

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*Notes on Mars, 1877.* By H. Pratt, Esq.

Opportunities of observing the planet have not been numerous, for the weather here has often been indifferent. Yet on several occasions when definition has been really fine some of the markings have been very definite, and although the majority presented softened outlines, yet their complexity could only be realised by close and patient attention. On such occasions the number and variety of curved forms has been constantly remarked.

\* It cannot be seen with ordinary definition.